C6 CQ 1,11; P 6,12,17,94,95 - due M 10/18
C6 CQ 5,8; P 78,86,106 - due M 10/25

C6CQ1 - The net force points in the same direciton as the acceleration (N2L), which points toward the center of the circle. The motion, on the other hand, is always perpendicular to that, i.e., tangential to the radius, thus the work is zero.

C6CQ 5 Static friction does no work because the displacement is always zero

C6CQ 8 As the gymnast comes downward, his/her graviatational energy decreases and kinetic energy increases so that the total energy remains rougly constant (not exactly constant because friction is doing negative work and the gymnast's muscles are adding energy, doing positive work).

C6CQ 11 - First, animals have elastic fibers in their legs that store energy during one part of the motion. The other design feature is slenderness, espcially near their hooves. This reduces the amount of work that needs to be done to change their speed, i.e., change in kinetic energy = net work.

C6 P6 – 402 kg hammer, $mg = 3940\,N$

(a) $W_{\text{by engine to raise}} = (3940\,N \uparrow)(12\,m \uparrow)\cos 0^\circ = 47.3\,kJ$

(b) $W_{\text{grav to raise}} = (3940\,N \downarrow)(12\,m \uparrow)\cos 180^\circ = -47.3\,kJ$

(c) $W_{\text{grav to lower}} = (3940\,N \downarrow)(12\,m \downarrow)\cos 0^\circ = +47.3\,kJ$

C6P12 $K = \frac{1}{2}mv^2$

$K_{mamm} = \frac{1}{2}(70.5\,kg)(27.8\,\frac{m}{s})^2 = 27.2\,kJ$

$K_{JH} = \frac{1}{2}(70.5\,kg)(68.04\,m/s)^2 = 163\,kJ$

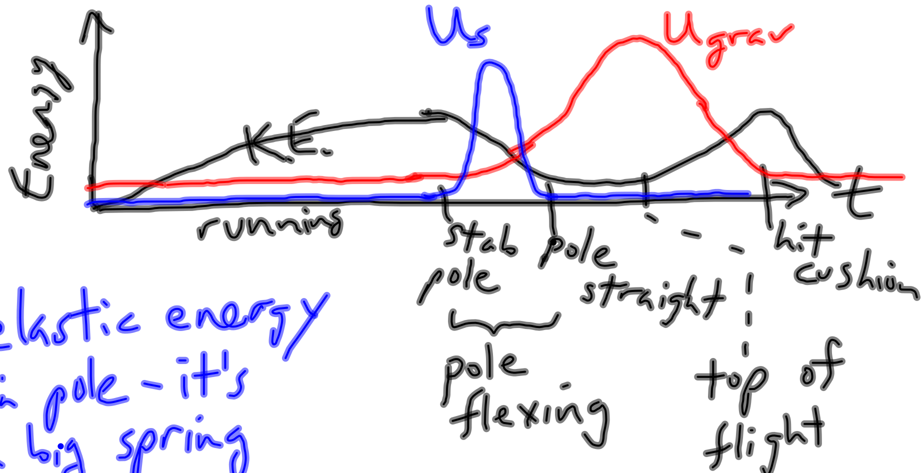
~6 * the energy!

C6 P17 $K_i = \frac{1}{2}mv^2 = \frac{1}{2}(69.0\,kg)(11.0\,\frac{m}{s})^2 = 4175\,J$

$W_{net} = \Delta K = 0 - 4175\,J = -4175\,J$

$= W_{wall\ on\ skater}$

C6 P78



U_s is elastic energy stored in pole - it's really a big spring

$Q - E_{running} = K + U_g + U_s$

$= \frac{1}{2}M(10\,m/s)^2 + Mg(1m) + 0 = 109.8M$

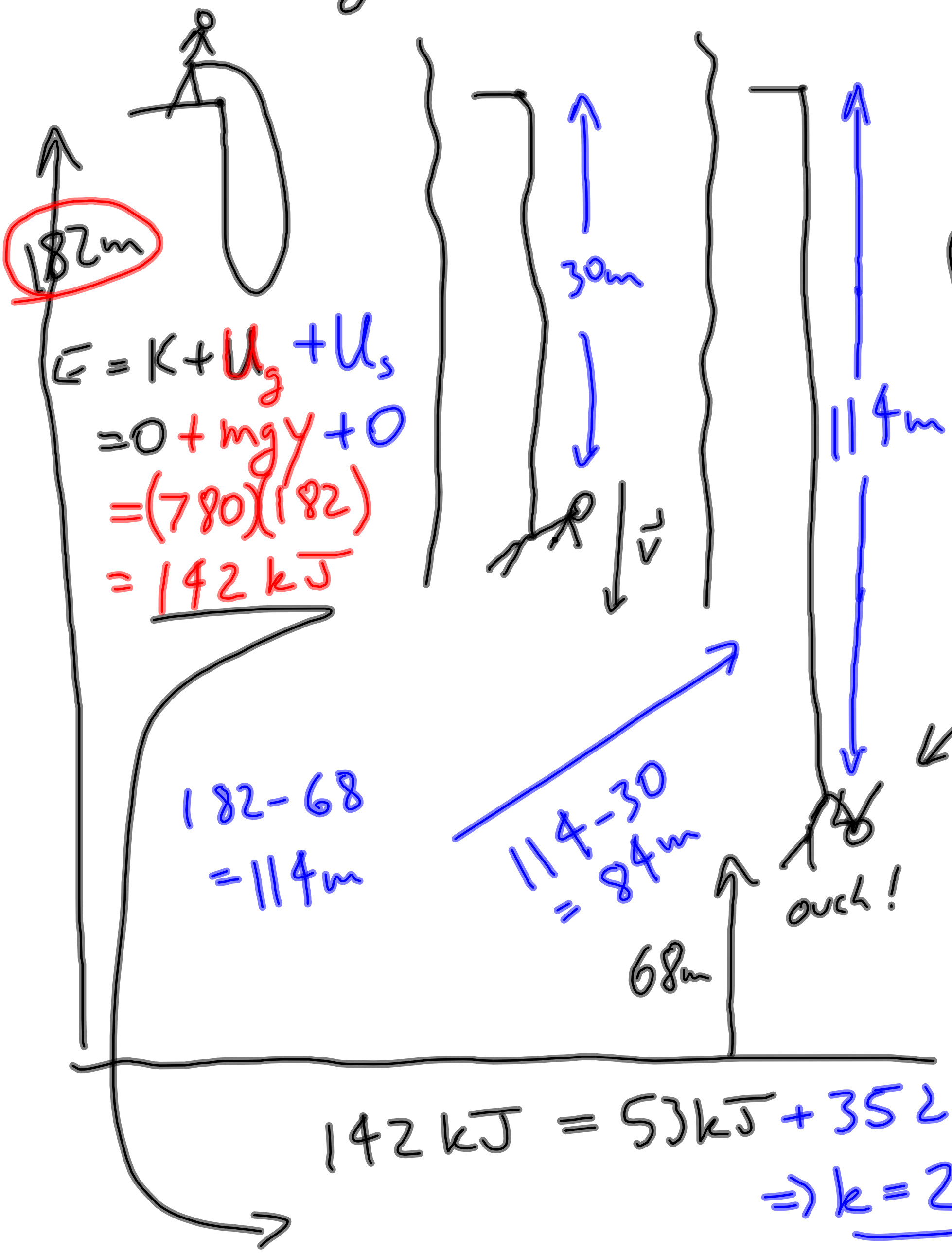
IF not this is the only energy (i.e., vaulter does not work w/ legs or arms), then

$E_{highest} = K + U_g + U_s$ ($K \to 0$ roughly, $U_s \to 0$)

$= Mgy = 109.8M$

$\Rightarrow y = \frac{109.8}{g} = 11.2m$!

C6P86 $mg = 780N$



$E = K + U_g + U_s$
$= 0 + mgy + 0$
$= (780)(182)$
$= 142\,kJ$

$182 - 68 = 114m$

$114 - 30 = 84m$

$E = K + U_g + U_s$
$= 0 + mgy + \frac{1}{2}kx^2$
$= (780)(68) + .5k(84m)^2$
$= 53\,kJ + 3528k$

$142\,kJ = 53\,kJ + 3528 \cdot k$
$\Rightarrow k = 25.2\ N/m$

C6P94 – $W_{net} = \Delta K = K_f - 0$ (ball orig. stopped)

$W_{by\ arm\ on\ ball}$ $= \frac{1}{2}mv^2 - 0 = \frac{1}{2}(.153\,kg)(40.2\,\frac{m}{s})^2$

$= 124\,J$

calories consumed $(.2) = 124\,J$, so

cal. consumed $= 618\,J$ per throw $\cdot \left(\frac{1\,kcal}{4185\,J}\right)$

$= .148\,kcal$

so N needs, $N(.148) = 1520\,kcal$

$\Rightarrow N = 10300$ throws

[If one thrown every 5 s, that's 51500 s = 14.3 hr!]

C6PT5 Resting @

$.015 \frac{mol}{min} \cdot \frac{1 kcal}{.010 mol} = 1.5 \frac{kcal}{min}\left(\frac{60 min}{hr}\right)\left(\frac{24 hr}{dy}\right)$

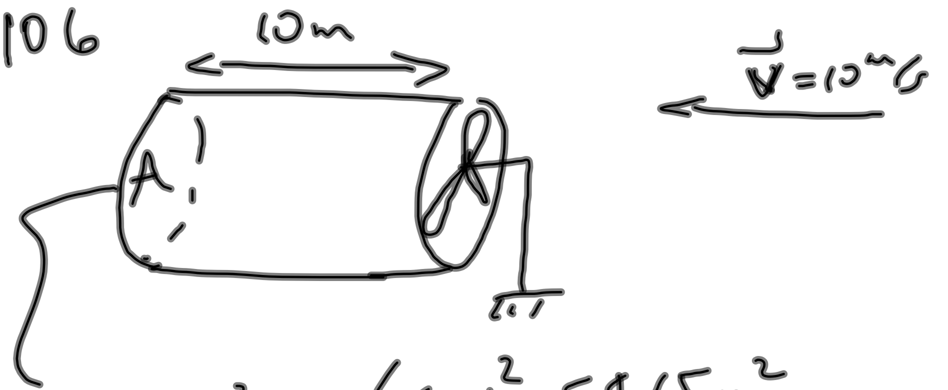
$= 2160$ kcal/dy

If J fasts 24 hrs & rests the whole time, he burns 2160 kcal

$\cdot \frac{1 gm}{9.3 kcal} = 232 gm = .232 kg = m$ lost

$mg = (.232 kg)(9.8 m/s^2) = 2.78 N\left(\frac{1 lb}{4.45 N}\right) = .5 lb$

C6P 106



$A = \pi r^2 = \pi(4m)^2 = 54.65\,m^2$

Vol of air travels $1s \cdot 10\,m/s = 10\,m$

is $546.5\,m^3$

$M_{air} = \rho V = (1.2\,\frac{kg}{m^3})(546.5\,m^3) = 655\,kg$

$K = \frac{1}{2}Mv^2 = \frac{1}{2}(655\,kg)(10\,\frac{m}{s})^2 = 32.8\,kJ$

If 40% is converted, thats $.4(32.8\,kJ) = 13.1\,kJ$

every second, so $13.1\,kW = 17.6\,hp$

If speed ↓ factor of 2, vol ↓ factor of 2 so M ↓ ÷2

& K ↓ factor of $2 \cdot 2 \cdot 2 = 8$ [M ↓ & v ↓, squared]

∴ P ↓ ÷8 to $1.6\,kW = 2.2\,hp$

∴ Need hi speed wind because $P \propto v^3$!

Nov 3-2:25 PM